

WHAT IS CLAIMED IS:

1. An ink supply system comprising:

a first ink storage area to store ink; and

5 a second ink storage area connected to the first ink storage area through a connecting means to introduce the ink from the first ink storage area for supply to a print head;

wherein the connecting means disconnectably connects  
10 the second ink storage area to the first ink storage area and, when the two ink storage areas are connected, forms a plurality of communication paths communicating the two ink storage areas with each other;

wherein the second ink storage area, excluding the  
15 plurality of communication paths and a connecting portion with the print head, virtually forms a hermetically closed space;

wherein, when the ink is refilled into the second ink storage area from the first ink storage area through at  
20 least one of the plurality of communication paths, a gas present in the second ink storage area can be transferred to the first ink storage area through at least one other communication path;

wherein the first ink storage area has a space to take  
25 in the gas transferred from the second ink storage area.

2. An ink supply system as claimed in claim 1, wherein

the first ink storage area has a means to introduce an atmosphere into the first ink storage area, without passing it through the second ink storage area.

5        3. An ink supply system as claimed in claim 1, wherein the plurality of communication paths have their openings on the first ink storage area side situated higher in a gravity direction than their openings on the second ink storage area side and also have an opening of the at least  
10 one communication path on the second ink storage area side situated higher in the gravity direction than an opening of the at least one other communication path on the second ink storage area side.

15        4. An ink supply system as claimed in claim 1, wherein, based on a relationship between a pressure that the ink in the first ink storage area applies to the second ink storage area, which is a virtually hermetically closed space, and a force of an ink meniscus formed in the at least one  
20 of the plurality of communication paths, a gas present in the second ink storage area is transferred into the first ink storage area through the at least one communication path while at the same time the ink is supplied from the first ink storage area into the second ink storage area  
25 through the at least one other communication path.

5. An ink supply system as claimed in claim 1, wherein

the opening, on the second ink storage area side, of the at least one of the plurality of communication paths is formed in contact with an inner wall of a container forming the second ink storage area.

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6. An ink supply system as claimed in claim 1, wherein the opening, on the second ink storage area side, of the at least one of the plurality of communication paths is formed with a groove that extends along the communication  
10 path toward the inside of the second ink storage area.

7. An ink supply system as claimed in claim 1, wherein the opening, on the second ink storage area side, of the at least one of the plurality of communication paths is  
15 in contact at all times with the ink in the second ink storage area.

8. An ink supply system as claimed in claim 1, wherein the plurality of communication paths have different contact  
20 angles between the inner wall thereof and the ink.

9. An ink supply system as claimed in claim 1, wherein the plurality of communication paths have different inner  
diameters.

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10. An ink supply system as claimed in claim 1, further comprising a means which, when the connecting means

disconnects a connecting portion on the second ink storage area side from a connecting portion on the first ink storage area side, hermetically closes the connecting portion on the second ink storage area side.

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11. An ink supply system as claimed in claim 1, wherein the second ink storage area has a printing portion that uses the ink, a second ink container storing the ink and the connecting means.

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12. An ink supply system as claimed in claim 11, wherein the second ink container is formed deformable.

13. An ink supply system as claimed in claim 11, wherein  
15 the second ink container has a negative pressure generation means to generate a negative pressure therein.

14. An ink supply system as claimed in claim 1, wherein  
20 at least a part of the first ink storage area is situated higher in the gravity direction than the connecting means.

15. An ink supply system as claimed in claim 14, wherein  
the first ink storage area has a first ink container to store the ink, a negative pressure generation means to  
25 generate a negative pressure in the first ink container, the connecting means and an ink supply portion to extract the ink.

16. An ink supply system as claimed in claim 15, wherein the first ink container has:

5 a movable member in at least a part thereof that defines an ink storage space and which, as the ink is supplied into the second ink storage area, can be displaced in a direction that reduces the ink storage space; and

a negative pressure generation means to generate a negative pressure in the ink storage space.

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17. An ink supply system as claimed in claim 16, wherein the first ink container has a member that urges the movable member in a direction opposite the direction in which the movable member can be displaced.

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18. An ink supply system as claimed in claim 15, wherein the first ink container has an atmosphere introducing means to introduce external air into the ink storage space from outside as the ink is supplied from the ink storage space  
20 into the second ink storage area.

19. An ink supply system as claimed in claim 15, wherein the first ink container can be replaced after the ink therein is consumed.

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20. An ink supply system as claimed in claim 15, wherein the first ink container is provided with a gas accommodating

chamber which is installed higher than the connecting means and accommodates a gas transferred from the second ink storage area.

5        21. An ink supply system as claimed in claim 20, wherein the gas accommodating chamber is deformable.

22. An ink supply system as claimed in claim 21, wherein the gas accommodating chamber has a maximum internal volume  
10        which is larger than an internal volume of an ink path, the ink path introducing the ink from the first ink container to the connecting means.

23. An ink supply system as claimed in claim 20, further  
15        comprising:

      a means which, when the connecting means disconnects a connecting portion on the second ink storage area side from a connecting portion on the first ink storage area side, hermetically closes the connecting portion on the  
20        first ink storage area side; and

      a means to reduce an internal volume of the gas accommodating chamber.

24. An ink supply system as claimed in claim 23, wherein  
25        the means to reduce the internal volume of the gas accommodating chamber is a means to press the gas accommodating chamber.

25. An ink jet printing apparatus for printing an image on a print medium by using an ink jet print head, the printing apparatus having an ink supply system defined in any one of claims 1 to 24 as a system to supply ink to the ink jet print head.

26. An ink jet printing apparatus as claimed in claim 25, further comprising:

10 a means to move the print head in a main scan direction; and

a transport means to transport the print medium in a subscan direction crossing the main scan direction;

wherein the first ink storage area is installed at a predetermined position in a body of the printing apparatus;

15 wherein the second ink storage area is installed movable with the print head;

wherein the connecting means, when the print head moves to a predetermined position in the main scan direction, connects the second ink storage area to the first ink storage area and, when the print head moves away from the predetermined position, disconnects the second ink storage area from the first ink storage area.

25 27. An ink container connected to an ink refilling portion through a connecting means to supply ink refilled from the ink refilling portion to a print head;

wherein the connecting means forms a plurality of communication paths which disconnectably connects the ink container to the ink refilling portion and, when the ink container is connected to the ink refilling portion,  
5 communicates them with each other;

wherein the ink container, excluding the plurality of communication paths and a connecting portion with the print head, virtually forms a hermetically closed space;

wherein, when the ink is refilled from the ink refilling  
10 portion to the ink container through at least one of the plurality of communication paths, a gas present in the ink container can be transferred to the ink refilling portion through at least one other communication path.

15 28. An ink container as claimed in claim 27,  
wherein the ink container is held on a movable carriage on which the print head is mounted;  
wherein the ink refilling portion is installed outside the movable carriage;

20 wherein at least a part of the plurality of communication paths is formed either in the ink container or the ink refilling portion.

25 29. An ink container as claimed in claim 28, wherein the plurality of communication paths have their openings on the ink refilling portion side situated higher in a gravity direction than their openings on the ink container side



and also have an opening of the at least one communication path on the ink container side situated higher in the gravity direction than an opening of the at least one other communication path on the ink container side.

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30. An ink container as claimed in claim 27, further comprising a means which, when the connecting means disconnects a connecting portion on the ink container side from the ink refilling portion, hermetically closes the  
10 connecting portion.

31. An ink container as claimed in claim 27, wherein an inner space of the ink container is formed deformable.

15 32. An ink container as claimed in claim 27, further comprising a negative pressure generation means to generate a negative pressure in an inner space of the ink container.

33. An ink container as claimed in claim 27, further  
20 comprising:

a flexible sheet to form at least a part of an inner space of the ink container; and

a spring member to urge the flexible sheet outwardly.

25 34. An ink jet cartridge comprising:  
an ink container defined in any one of claims 27 to 33; and

an ink jet print head capable of ejecting ink supplied from the ink container.

35. An ink refilling container connected to an ink  
5 container through a connecting means to refill ink into the ink container, the ink container supplying ink to a print head,

wherein the connecting means disconnectably connects the ink container to the ink refilling container and, when  
10 the ink container and the ink refilling container are connected, forms a plurality of communication paths communicating the ink container and the ink refilling container with each other;

wherein the ink container, excluding the plurality of  
15 communication paths and a connecting portion with the print head, virtually forms a hermetically closed space;

wherein, when the ink is refilled into the ink container from the ink refilling container through at least one of the plurality of communication paths, a gas present in the  
20 ink container can be transferred to the ink refilling container through at least one other communication path;

wherein the ink refilling container has a space to take in the gas transferred from the ink container.

25 36. An ink refilling container as claimed in claim 35, wherein the ink container is held on a movable carriage on which the print head is mounted;

wherein the ink refilling container is installed outside the movable carriage;

wherein at least a part of the plurality of communication paths is formed either in the ink container or the ink  
5 refilling container.

37. An ink refilling container as claimed in claim 35, further comprising a negative pressure generation means to generate a negative pressure in the ink refilling  
10 container, the connecting means and an ink supply portion to extract the ink.

38. An ink refilling container as claimed in claim 35, further comprising:  
15 a movable member in at least a part thereof that defines an ink storage space and which, as the ink is supplied into the ink container, can be displaced in a direction that reduces the ink storage space; and

a negative pressure generation means to generate a  
20 negative pressure in the ink storage space.

39. An ink refilling container as claimed in claim 38, further comprising a member that urges the movable member in a direction opposite the direction in which the movable  
25 member can be displaced.

40. An ink refilling container as claimed in claim 35,

further comprising an atmosphere introducing means to introduce external air into an ink storage space in the ink refilling container from outside as the ink is supplied from the ink storage space into the ink container.

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